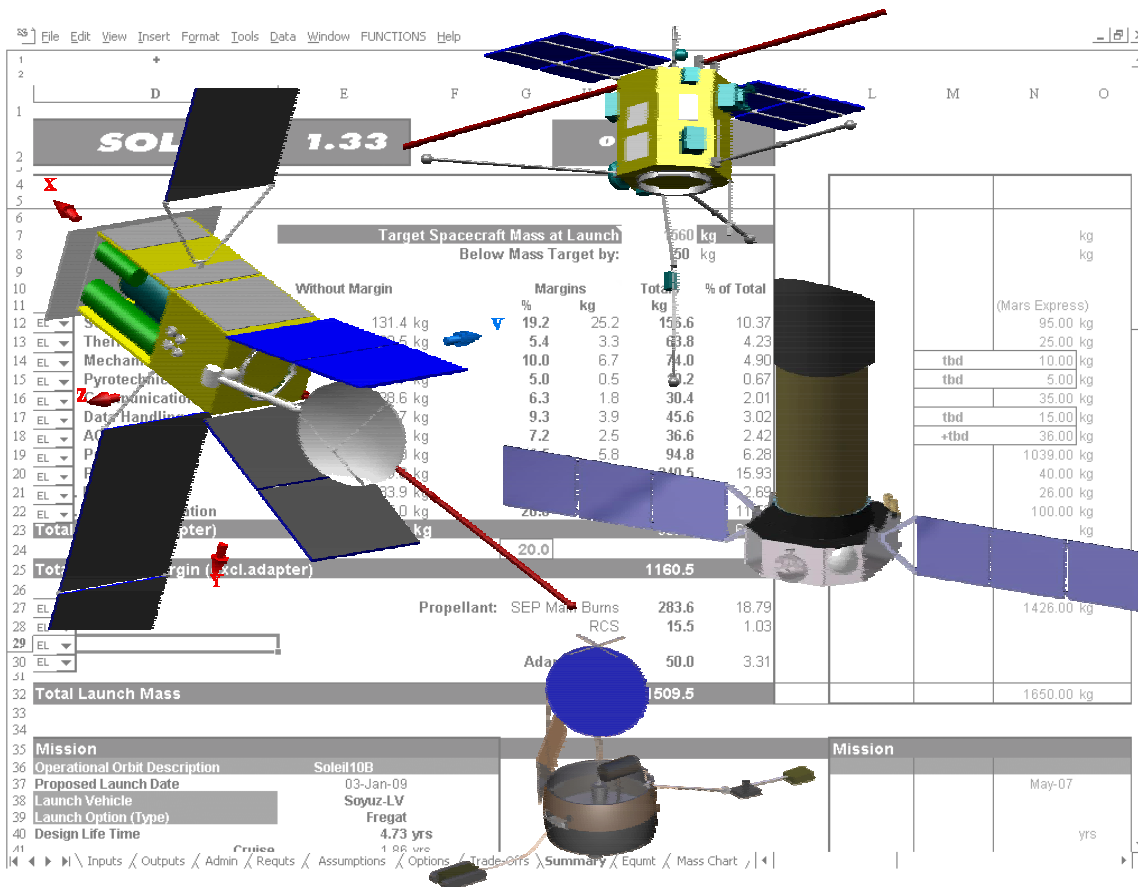
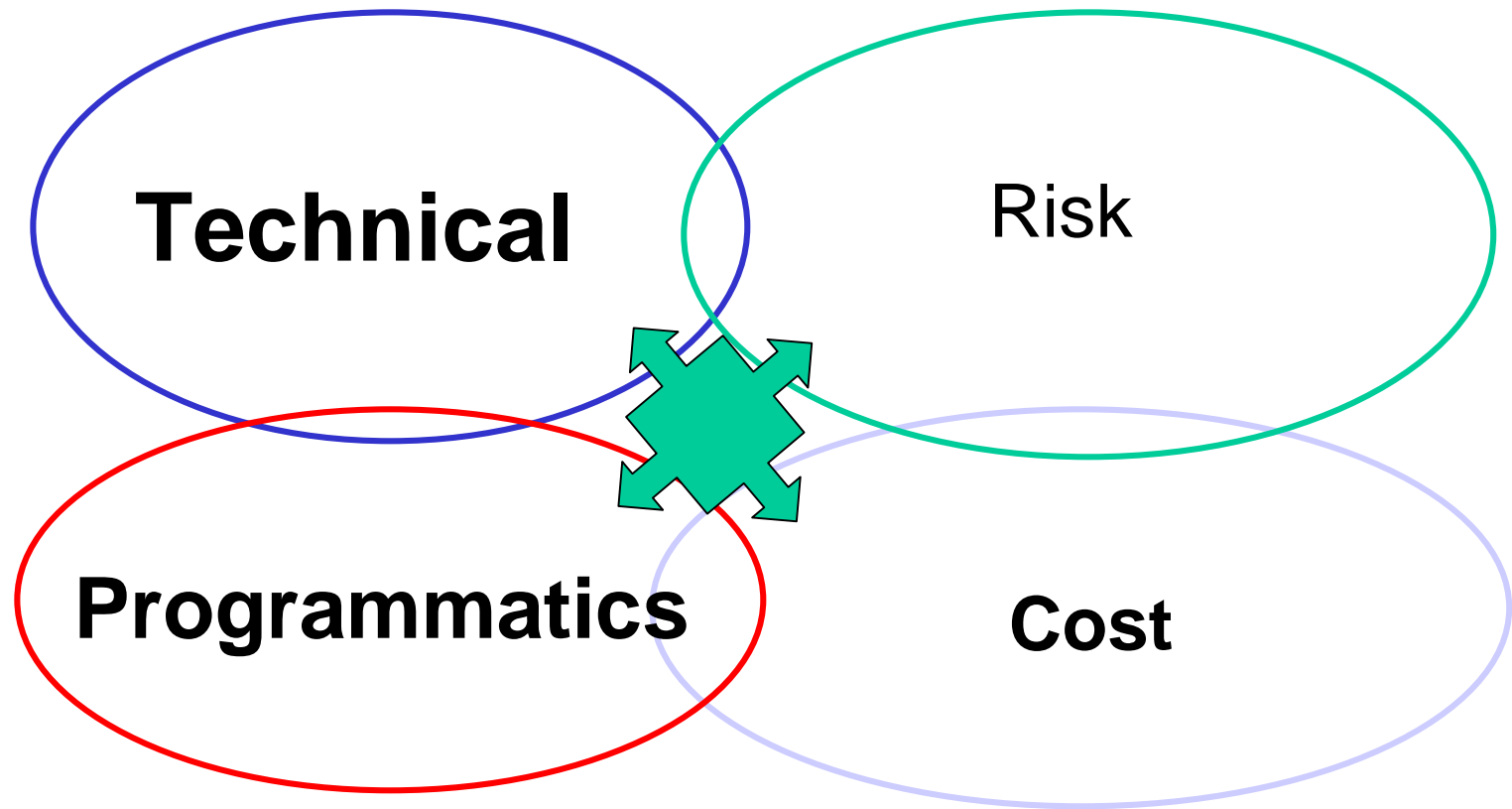


## Advanced applications of the ESA Concurrent Design Facility (CDF)

presented by  
**Massimo Bandecchi**  
ESA/ESTEC - TOS-P  
**Franco Ongaro**  
ESA/HQ- SER-A



# Space Mission Feasibility

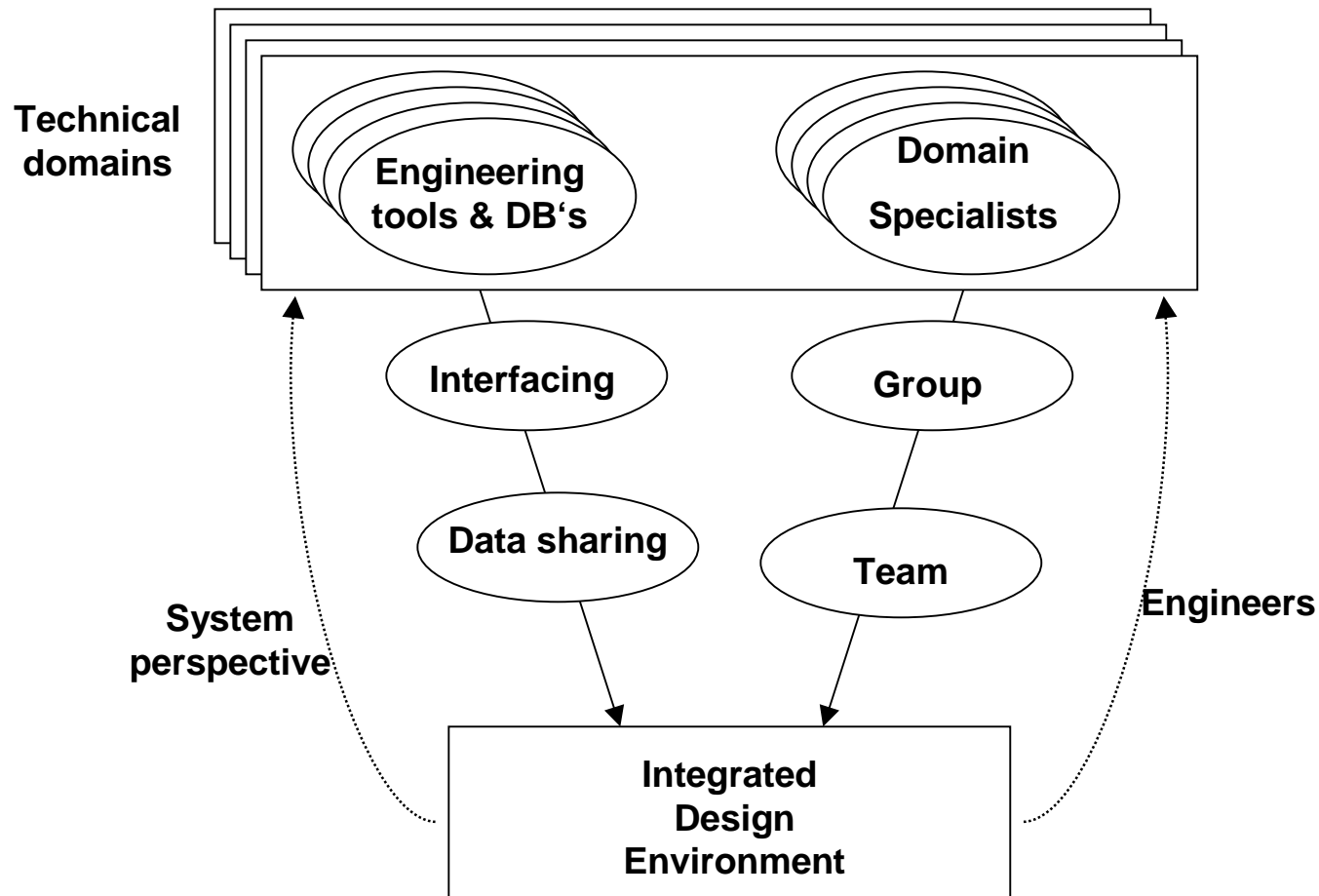


# CDF: the objectives

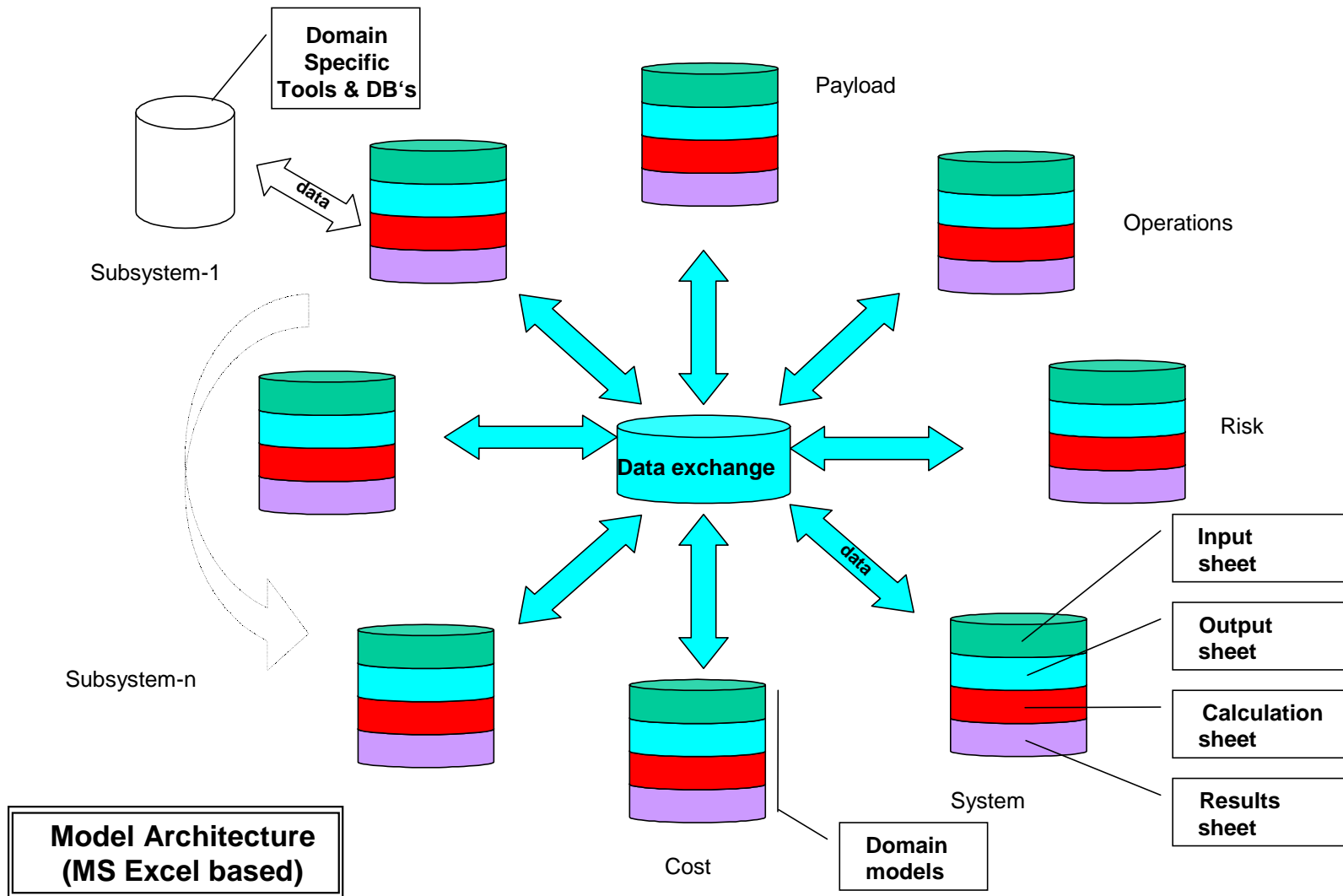
- The Concurrent Design Facility was established at ESTEC in Nov. 1998, on experimental basis, with the scope to provide:
  - a **mission design environment** for the conceptual design of new space missions (currently applied to internal pre-phase A / level 0 assessment studies)
  - a set up for the **application of concurrent engineering principles**
  - a more **effective organisation** of existing mission analysis and design tools and human resources
  - a generic approach to **capture corporate knowledge** for further reuse

# CDF: approach

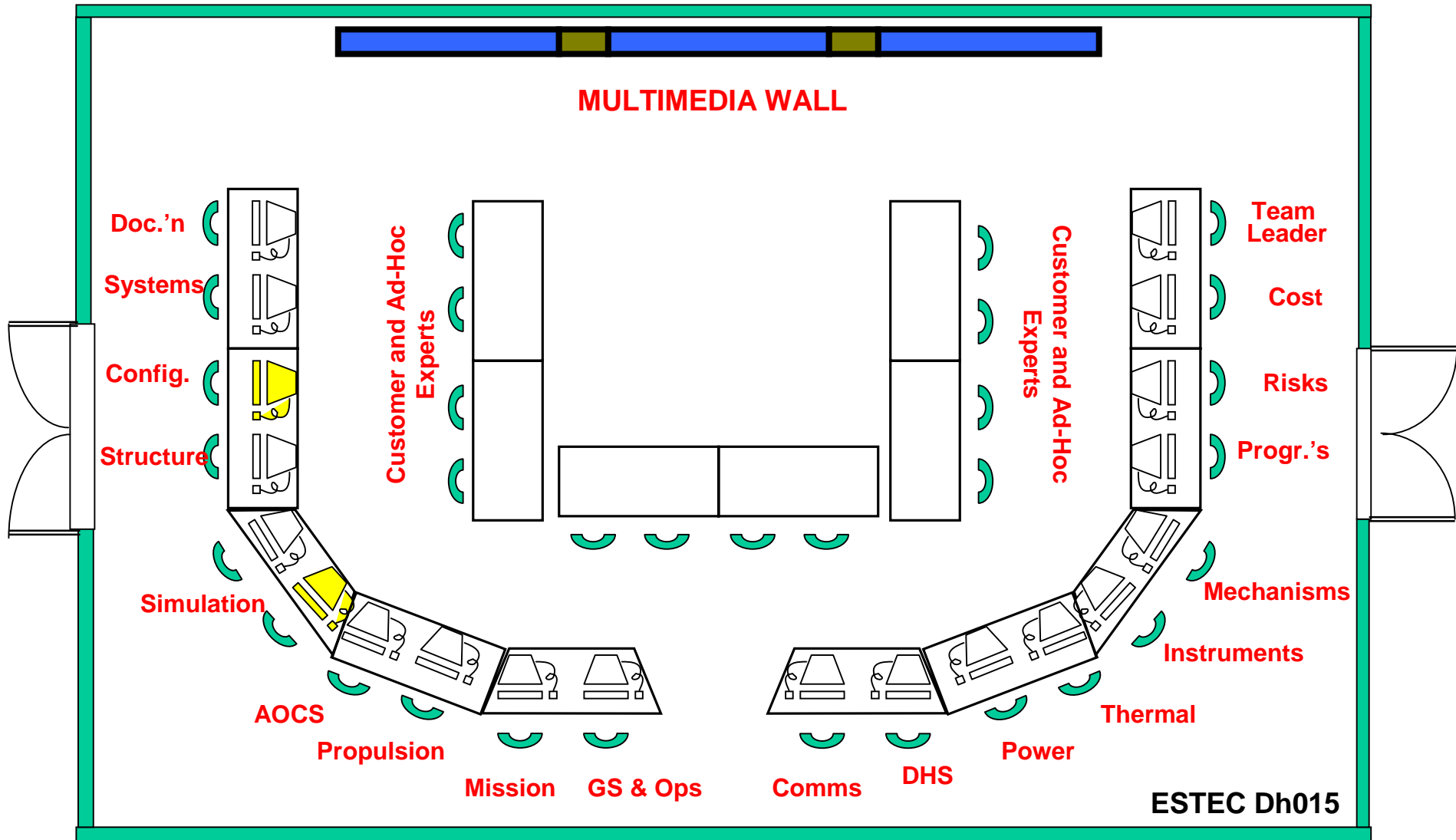
- Re-organization of existing tools and human resources in a more effective (i.e. “concurrent”) way



# CDF: integrated design model



# The ESTEC CDF: layout



## CDF: studies performed (Jan.'99 to date)

- **CESAR99**
- **Solar Orbiter**
- **Meteo Imager Sounder Satellite - MISS**
- **World Space Observatory - WSO/UV**
- **Mercury Surface Element - MeSE**
- **Eddington**
- **MASTER**
- **STORMS**
- **Hyper**
- **Ocean Earth Watch**

## CDF: the present...

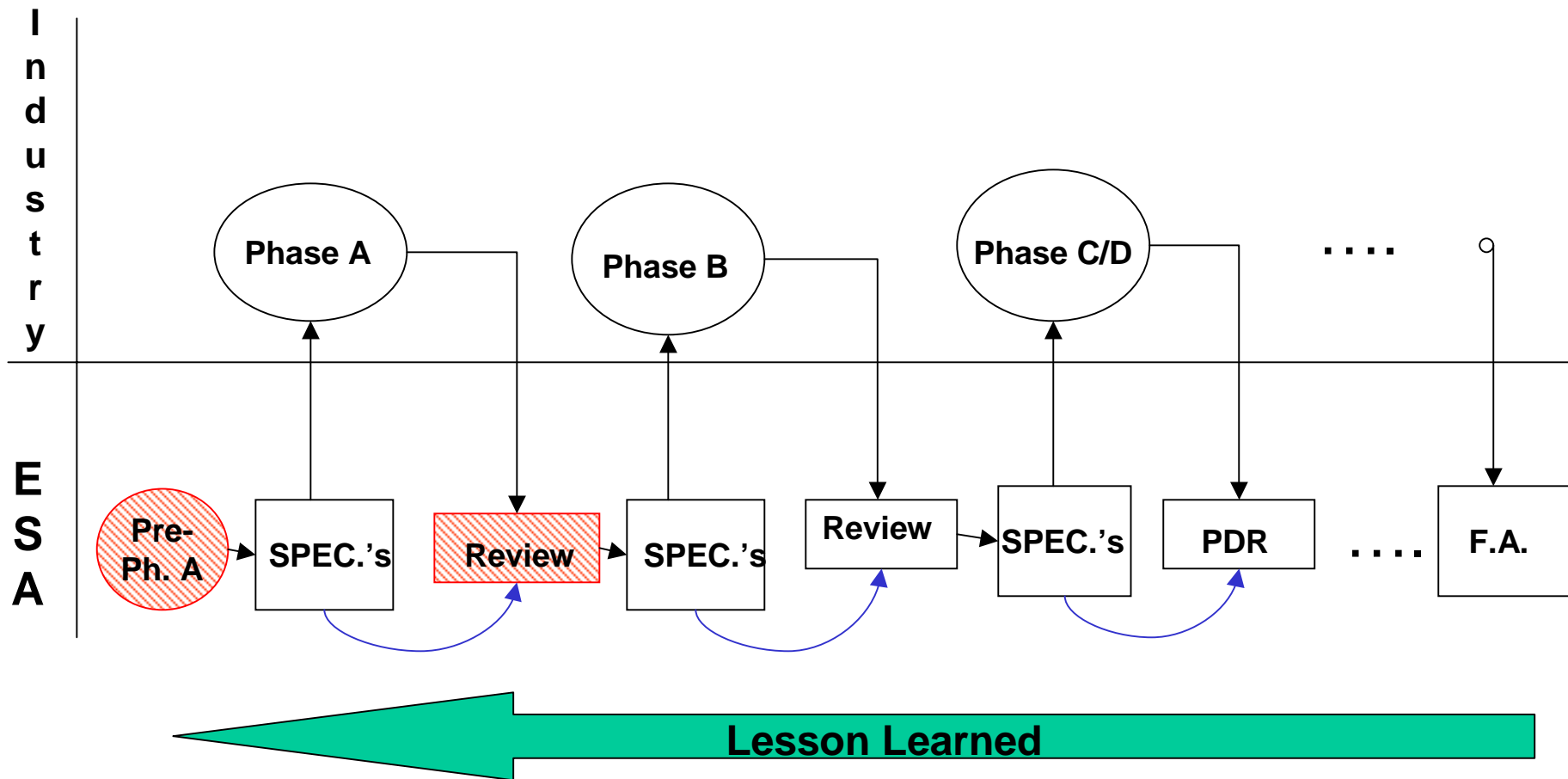
- The ESTEC CDF has become a functioning, operational and accepted component of the ESA in-house mission design assessment process

## ... and the future

- Other possible applications of the method and facility in the ESA context:
  - support reviews,
  - system requirements definition,
  - proposal evaluation,
  - instrument conceptual design,
  - training,
  - ...



# The ESA context



## Phase A Industrial Study reviews

- **LISA: Laser Interferometer Space Antenna**
- **STEP: Satellite for the Test of the Equivalence Principle**
- **decision to run these reviews in CDF was taken “a- posteriori” <sup>(1)</sup>**
- **review in 2 steps:**
  - **internal review - model based <sup>(2)</sup>**
  - **involvement of industrial team (either locally or remotely)**

**(1) Model input interface specification will facilitate the review activity (foreseen for BepiColombo)**

**(2) allowed:**

- a) the implicit verification of the model consistency,**
- b) the verification of alternative design options**

# Support Industrial Phase A for ISS facilities

## Dusty Plasma (ICAPS):

- Collaborative management and distributed support
- Scientific Requirements Definition took place in CDF on June 14-15

## Achievements:

- improved communication and understanding between scientific and engineering teams
- simultaneous definition and agreement by all parties

**2 more ISS facilities (Phase A/B) foreseen in 2001**

# ESTEC CDF / JPL Team X STEP joint design results

**STEP** a multi-national project where the payload is provided by Stanford and the service module by **ESA**

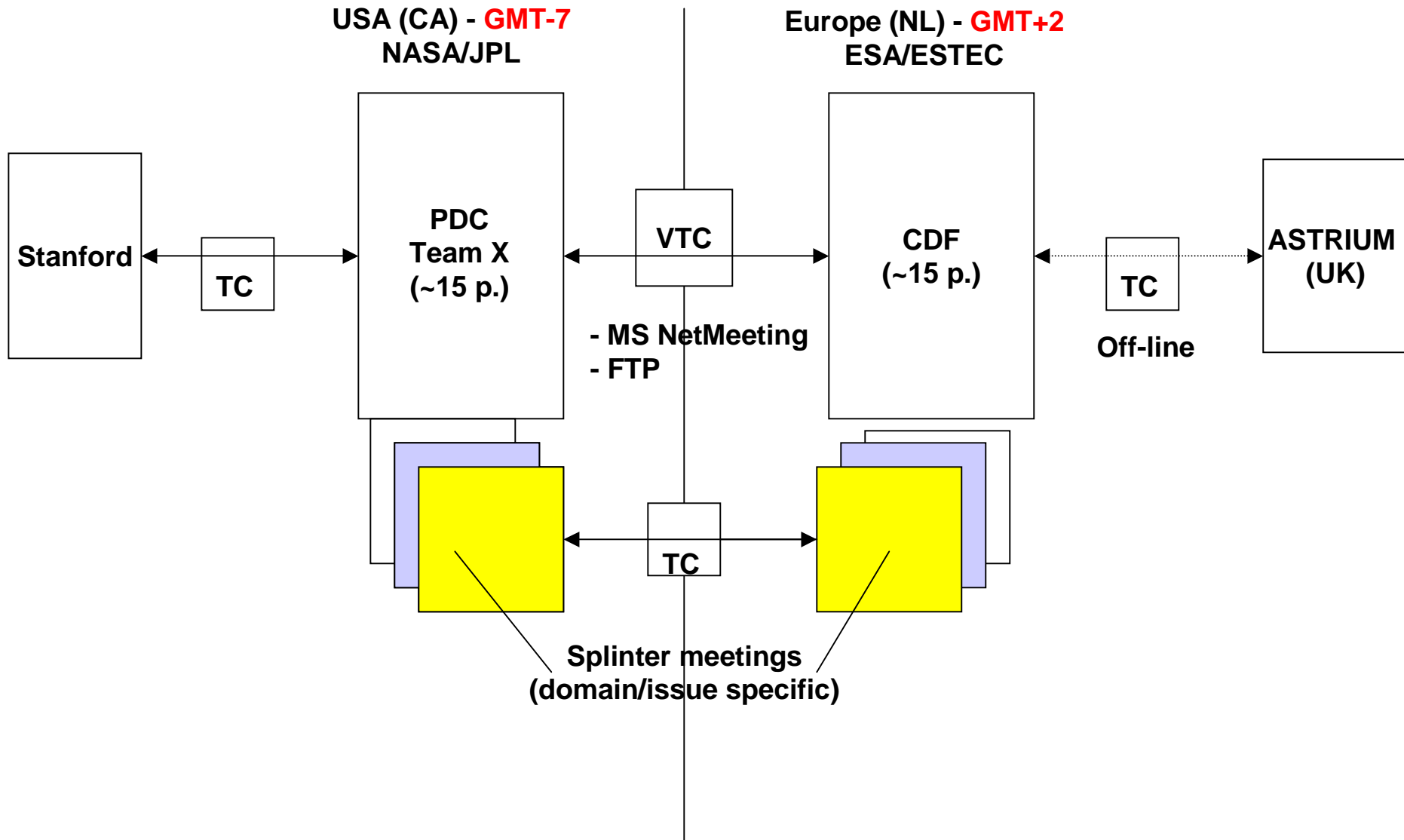
**Joint sessions analysed:**

- **Design baseline**
- **Critical issues**
- **Interfaces**

**Joint sessions produced mutually agreed:**

- **Conceptual design iteration and finalisation**
- **ICD**
- **System requirements**

# ESTEC CDF / JPL Team X STEP joint design sessions



# CDF: other applications

## Phase B, C/D

- **Project review of more advanced phases**
- **Structuring and better organisation of the reviews**
- **Ideally: standardised documentation**
- **above all: standardised data exchanged**

## CDF: other applications (1/2)

### Model the “Unconventional”

- **R&D activity**
- **Verification of new technologies at mission/system level**
- **System evaluation of advantages/disadvantages of certain technology programmes**
- **Verify before recommending to Industry**

# Distributed Concurrent Development

- need for a more performant infrastructure, quality step-up:
- what's beyond Excel?
- which role is GRID going to play?



## CDF: other applications (2/2)

### CDF for Education:

- recent requests and initiatives by some university aerospace departments to use the CDF (or CDF-type environment) as an educational tool
  - first experience (experimental phase)
- ⇒ Education is an important objective but is not the primary reason to have built the facility
- ⇒ might give the opportunity to check the portability of the facility

## **CDF and education: the SSETI experience**

- **SSETI (Student Space Exploration & Technology Initiative): a network of students, educational institutions and organisations using Internet to perform distributed design and possibly construction and launch of (micro)-satellites**
- **SSETI counts more than 400 participants from 77 European universities**
- **design data structure, models and exchange mechanisms similar to those used by CDF !!**
- **Moon mission microsatellite phase A study review using the CDF performed by ESA specialists jointly with the students**
- **technical sessions/lecture held in the CDF from 1 - 4 May 2001**

## The SSETI Workshop (2/2): quotes

- Lusastro Team (AOCS & ground station), Lisboa, Portugal:  
“... One of the best things, appeared to be the allowance to use the CDF (concurrent design facility), where we learned how to design and implement things in a co-ordinated way.”
- Thermal team, Manchester, United Kingdom  
“... The use of the Concurrent Design Facility showed that we were producing good work, and that such projects can be undertaken in a distributed way.”